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Conference Abstract

Architectural Pattern: Study of orchid architecture using tools to take quick measurements of virtual specimens

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Abstract

The joint use of two tools applied to plant description, *XPER3* and *RecolNat Annotate*, made it possible to study vegetative architectural patterns (Fig. 1) of the *Dendrobium* (Orchidaceae) in New Caledonia defined by N. Hallé (1977). This approach is not directly related to taxonomy, but to the definition of sets of species grouped according to a growth pattern.

In the course of this work, the characters stated by N. Hallé were analysed and eventually amended to produce a data matrix and generate an identification key.

Study materials: *Dendrobium* Sw. in New Caledonia

New Caledonia is an archipelago in the Pacific Ocean, a French overseas territory located east of Australia. It is one of the 36 biodiversity hotspots in the world.

The genus *Dendrobium* Sw. *sensu lato* is one of the largest in the family Orchidaceae and contains over 1220 species. In New Caledonia, it includes 46 species. In his revision of the family, N. Hallé (1977) defined 14 architectural groups, into which he divided the 31 species known at that time. These models are based on those defined by F. Hallé and

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Oldeman (1970). But they are clearly intended to group species together for identification purposes.

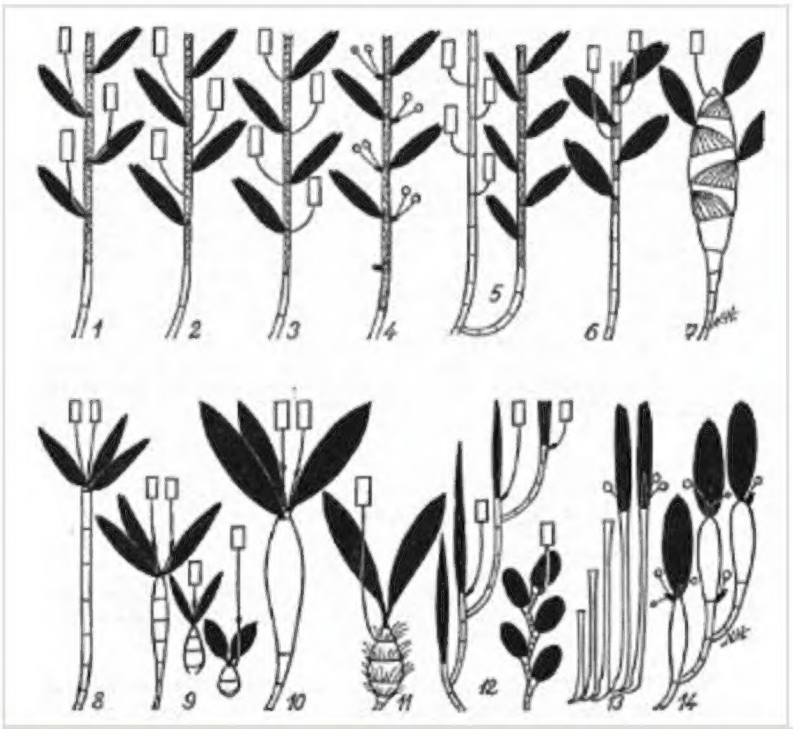

Figure 1.

Architectural patterns of the genus *Dendrobium* and allies in New Caledonia (Hallé 1977).

Architectural pattern:

A pattern is a set of vegetative or reproductive characters that define the general shape of an individual. Developed by mechanisms linked to the dominance of the terminal buds, the architectural groups are differentiated by the arrangement of the leaves, the position of the inflorescences or the shape of the stem (Fig. 1). Plants obeying a given pattern do not necessarily have phylogenetic relationships. These models have a useful application in the field for identifying groups of plants.

Monocotyledonous plants, and in particular the Orchidaceae, lend themselves well to this approach, which produces stable architectural patterns.

Recolnat Annotate

Recolnat Annotate is a free tool for observing qualitative features and making physical measurements (angle, length, area) of images. It can be used offline and downloaded from https://www.recolnat.org/en/annotate.

The software is based on the setting up observation projects that group together a batch of herbarium images to be studied, associating it with a descriptive model. A file of measurements can be exported in comma separated value (csv) format for further analysis (Fig. 2).

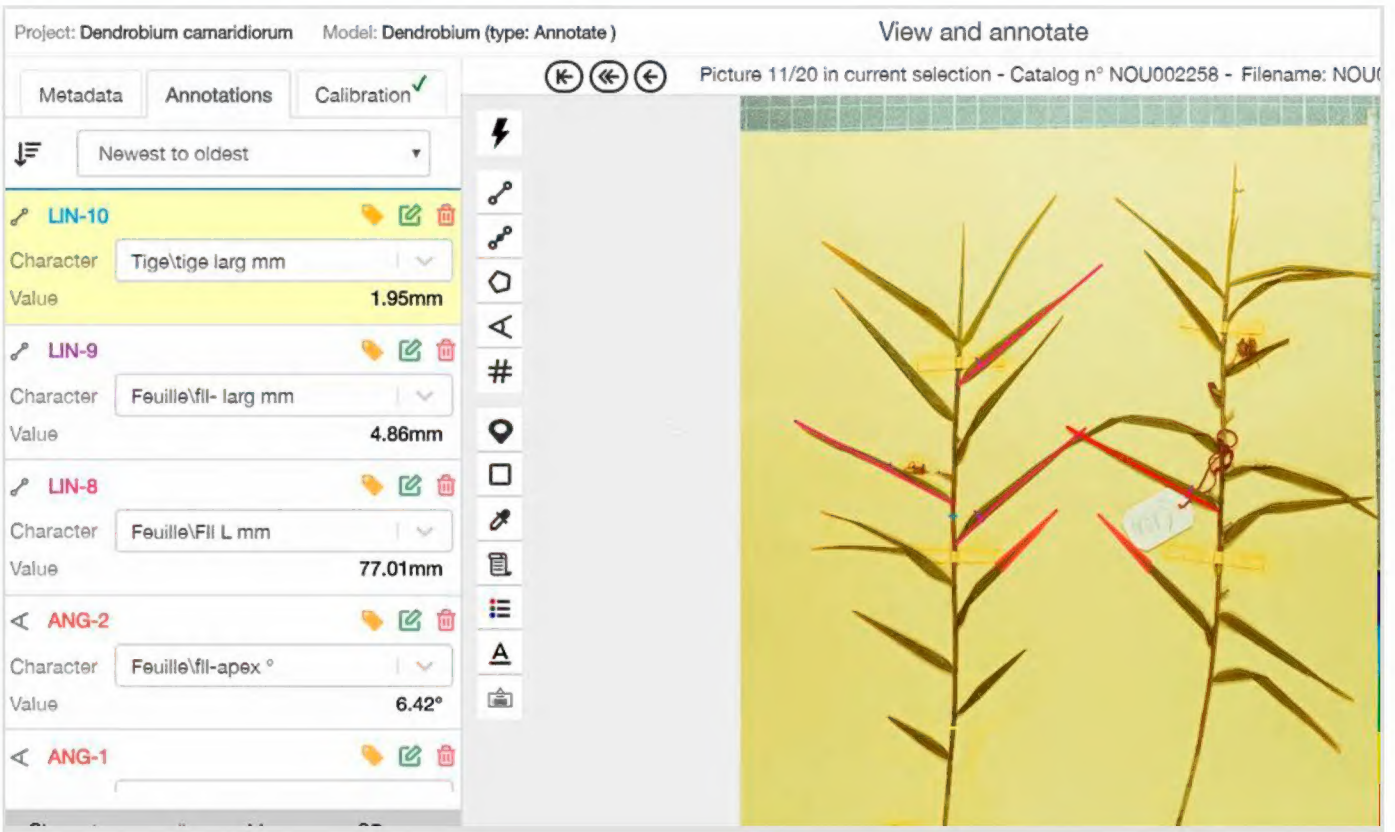

Figure 2.

Recolnat Annotate herbarium sheet annotations.

XPER3

Usually used in the context of systematics in which the items studied are taxa, *XPER3* can also be used to distinguish architectural groups that are not phylogenetically related.

Developed by the *Laboratoire d'Informatique et Systématique* (LIS) of the Institut de Systématique, Evolution, Biodiversité in Paris, *XPER3* is an online collaborative platform that allows the editing of descriptive data (https://www.xper3.fr/?language=en).

This tool allows the cross-referencing of items (in this case architectural groups) and descriptors (or characters). It allows the development of free access identification keys (it means without fixed sequence of identification steps). The latter can be used directly online. But it also offers to produce single-access keys, with or without using character weighting and dependencies between characters.

Links between XPER3 and Recolnat Annotate

The descriptive model used by *Recolnat Annotate* can be developed within the framework of *XPER3*, which provides for characters and character states. Thus the observations made by the *Recolnat Annotate* measurement tool can be integrated into the *XPER3* platform. Specimens can then be compared, or several descriptions can be merged to express the description of a species (Fig. 3).

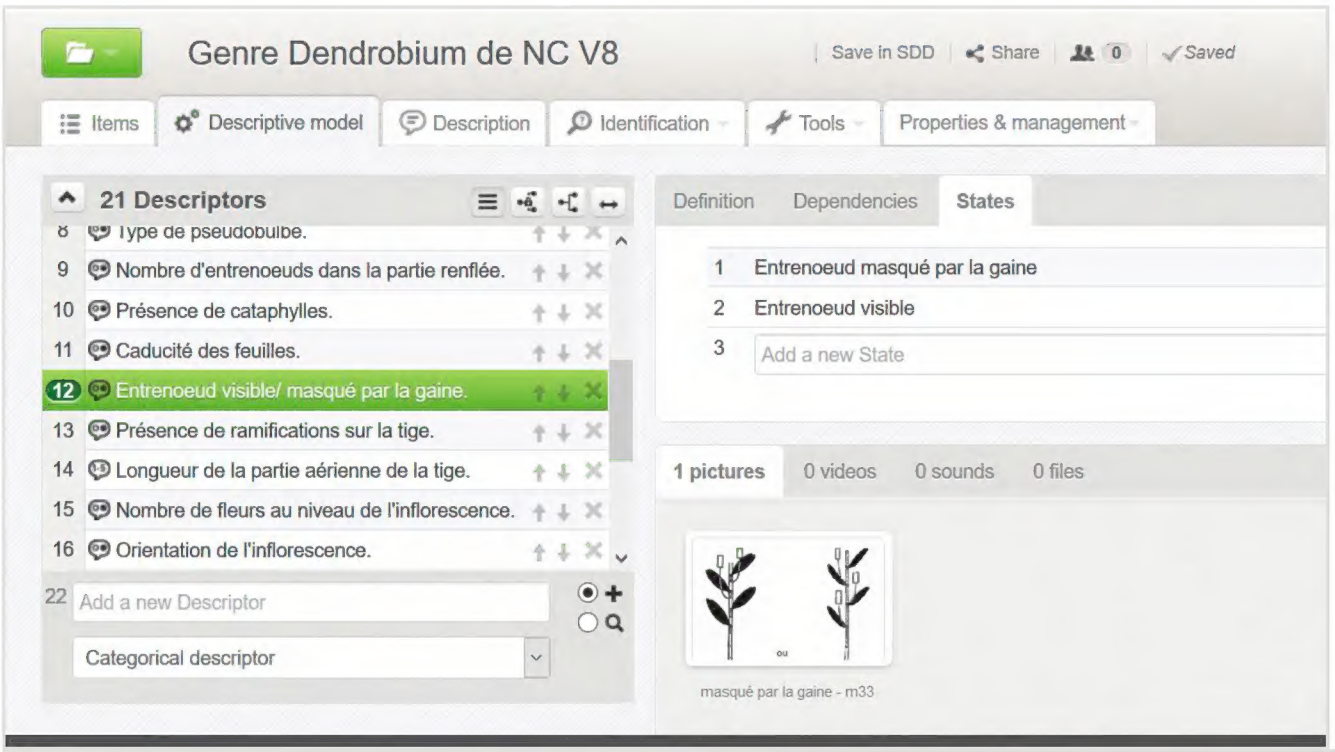

Figure 3.

Knowledge base on architectural patterns of *Dendrobium* in New Caledonia

RESULTS

The joint use of *XPER3* and *Recolnat Annotate* to manage both herbarium specimens and architectural patterns has proven to be relevant. Moreover, the measurements on the virtual specimens are fast and reliable.

N. Hallé (1977) had produced a dichotomous single-accesskey that allowed the identification and attribution of a pattern to a plant observed in the field or in a herbarium. The project to build a polytomous and interactive key with *XPER3* required completing the observations to give a status for each character of each vegetative architectural model.

Recolnat Annotate was used to produce observations from herbarium network in France. The use of *XPER3* has allowed us to redefine these models in the light of new data from the herbaria and to publish the interactive key available at dendrobium-nc.identificationkey.org.

Keywords

Dendrobium, Orchidaceae, XPER3, RECOLNAT, Recolnat Annotate, herbarium, interactive key, virtual specimens

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